WE CLAIM

1. A microporous and nanoporous polymeric material based on syndiotactic polystyrene in the δ crystalline form with an apparent density of 0.001 - 0.8 g/cm^3 and a percentage of crystallinity between 5-70%, prepared according to a process comprising:
a) preparation of a gel based on syndiotactic homopolymer or copolymers of styrene, at a polymer concentration between 0.1 and 50 wt% in a solvent or a mixture of solvents, one of which being a suitable guest of a syndiotactic polystyrene clathrate phase, wherein the copolymers contain as comonomers CH_2=CH-R olefins, wherein R is an alkyl-aryl or a substituted-aryl radical with 6-20 carbon atoms and
b) removal of the solvent from the gel by liquid or supercritical carbon dioxide extraction process, operating at a pressure between 50 and 350 bar and a temperature between 20 and 70°C.

2. The polymeric material according to claim 1, wherein the homopolymer or copolymer concentration in the gel is in the range 0.5 - 30 wt%.

3. The polymeric material according to claim 2, wherein the gel is a physical gel characterized by the absence of chemical cross-links between polymer chains.

4. The polymeric material according to claim 2, wherein the gel is a chemical gel characterized by chemical cross-links between polymer chains.

5. The polymeric material according to claim 4, wherein said chemical gel is prepared by polymerization comprising an at least bi-functional monomer.

6. The polymeric material according to claim 5, wherein the fraction of comonomer units derived from the at least bi-functional monomers used as cross linking agents is between 0.1 and 20 mol%.

7. The polymeric material according to claim 6, wherein the fraction of comonomer units derived from the at least bi-functional monomers used as cross-linking agents is below 10 mol%.

8. A process for preparing a microporous and nanoporous polymeric material based on syndiotactic polystyrene being in the δ crystalline form, said process comprising:
a) preparation of a gel based on homopolymers or copolymers of syndiotactic polystyrene, at a polymer concentration between 0.1 and 50 wt% in a solvent or a mixture of solvents, at least one of said solvents being a suitable guest of a clathrate phase of syndiotactic polystyrene, wherein the copolymers contain as comonomeric units CH_2=CH-R olefins, where R is an alkyl-aryl or a substituted-aryl radical with 6-20 carbon atoms and
b) removal of the solvent from the gel by liquid or supercritical carbon dioxide extraction process, operating at a pressure between 50 and 350 bar and a temperature between 20 and 70°C.

9. The process according to claim 8, wherein the homopolymer or copolymer concentration in the gel is in the range 0.5-30 wt%.

10. The process according to claim 9, wherein said gel is a physical gel characterized by the absence of chemical cross-links between polymer chains.

11. The process according to claim 9, wherein said gel is a chemical gel characterized by chemical cross-links between polymer chains.

12. The process according to claim 11, wherein said chemical gel is prepared by polymerization comprising at least bi-functional monomers.

13. The process according to claim 12, wherein the fraction of comonomer units derived from the at least bi-functional monomers used as cross linking agents is between 0.1 and 20 mol%.

14. The process according to claim 13, wherein the fraction of comonomer units derived from the at least bi-functional monomers used as cross linking agents is below 10 mol%.

15. The process according to claim 8, wherein said gel based on homopolymers or copolymers of syndiotactic polystyrene is prepared in situ through a polymerization reaction comprising styrene which acts both as monomer and solvent of the reaction.

16. A process of using a microporous and nanoporous polymeric material as claimed in claim 1, said process comprising: absorbing volatile chemical compounds, alone or when present in a liquid or gaseous mixture, to sorbing elements comprising said polymeric material.

17. A device and/or a sensor for detection of organic volatile compounds comprising a microporous and nanoporous polymeric material as claimed in claim 1.